MISSOURI DNR
MECHANICAL/ELECTRICAL/FIRE PROTECTION
SCHEMATIC DESIGN CRITERIA

INTRODUCTION

This document outlines the scope of the mechanical/electrical/and fire protection (MEP) systems to be designed by FSC/Smith & Boucher. It is intended to communicate the key aspects of the MEP systems to the Owner, Architect, and FSC/Smith & Boucher designers so that all parties are informed and working towards the same goals.

Also refer to the document "DNR Green Building Relocation Automation Issues" dated August 1, 2000 which addresses computer room and communications cabling topics.

GENERAL

I. UTILITY SERVICES

A. Domestic Water Service: A 4" domestic water main will be extended into the building. A reduced pressure type backflow preventor will be installed inside the building. A pressure reducing valve will be installed in the water service line to limit the incoming water pressure to 80 psig if required.

B. Fire Water Service: A 6" fire protection service will be extended to the building. A double check backflow preventer will be installed in the fire service line inside the building. An inside monitored OS&Y valve will be utilized rather than a post indicator valve. Both the backflow preventer and the OS&Y valve will be located in a Water Service Room approximately 10' x 12' in size. A free standing fire department connection with 2-1/2" threaded, capped outlets will be provided just outside the Water Service Room.

C. Natural Gas Service: Gas piping will be extended to a gas meter and regulator which will be provided by the Utility Company and located near the building.

D. Electric Service: Empty primary conduit will be extended underground from the property line to a padmount transformer located next to the building. The transformer and primary conductors will be provided by the Utility Company. A freestanding support and meter box will be provided for Utility Company secondary metering and located adjacent to the transformer. A 1-1/4" conduit will be provided from the meter box to the transformer or 480V switchboard for Utility Company metering conductors. Secondary conduit and wiring will be run underground from the transformer to the main

switchboard located in the Electrical Service Room. Electrical service capacity will be approximately 1600A at 480/277V 3-phase, 4-wire.

H. Communications Services: Two empty 4" conduit with innerducts will be extended into the building communications room.

I. The utility providers for the project will be as follows:

1. Electricity: American UE.

2. Gas:

3. Telephone:

4. Water:

5. Waste water:

6. Cable television: Owner determined.

II. CODES AND STANDARDS

A. The following codes shall be used in the design of this project.

1. International Building Code - 2000 Edition

2. International Mechanical Code - 2000 Edition

3. International Plumbing Code - 2000 Edition

4. International Fire Code – 2000 Edition

5. National Fire Protection Codes (latest editions)

   a. NFPA 13 - Sprinklers
   b. NFPA72 - Fire Alarm Systems
   c. NFPA 90A - HVAC Systems
   d. NFPA 101 - Life Safety Code

6. National Electric Code - 1999

7. Americans With Disabilities Act (latest edition)

8. ASME/ANSI - A17.1 - Elevators and Escalators (latest edition)

B. The building is located in an International Building Code Seismic zone with a 25% "g" factor. Specifications will require all mechanical and electrical systems to be braced in accordance with the requirements for this seismic zone.

DIVISION 15000
MECHANICAL AND FIRE PROTECTION

I. MECHANICAL SYSTEM MATERIALS

A. Piping for the mechanical systems shall be as follows:

1. Domestic Water Service (Underground): Cast iron pipe with ductile iron fittings and mechanical joints.

2. Fire Protection Service (Underground): Cast iron pipe with ductile iron fittings and mechanical joints.

3. Domestic water (interior): Type L hard copper with wrought copper fittings and sweat joints. All sweat joints shall contain 95-5 lead free solder.

4. Soil, waste, vent and storm piping (above grade): Service weight cast iron piping with drainage pattern fittings and Tyseal or No-hub joints.

5. Soil, waste, vent and storm piping (underground): Service weight cast iron piping with drainage pattern fittings and Tyseal joints.

6. Sprinkler and standpipe piping: Thin-wall Schedule 10 minimum black steel pipe with wrought or forged steel fittings and roll grooved or threaded joints.

   a. Dry pipe system piping shall be galvanized.
   b. Sprinkler heads shall line up but are not required to be centered in ceiling tiles.

7. Gas piping: Schedule 40 black steel; with plastic coating below grade only. Fittings will be standard weight black steel welding fittings with welded joints. Underground horizontal piping will be polyethylene PE 3406, SDR-11 with socket type or butt type fusion welded joints.

8. Chilled and condenser water piping: Schedule 40 black steel except copper 2-1/2" and smaller.

9. Heating hot water piping: : Schedule 40 black steel except copper 2-1/2" and smaller.

B. Insulation for mechanical systems shall be as follows:

1. Domestic water: 1/2" fiberglass with all service jacket and vapor barrier (1/2" – 2" pipe); 1" fiberglass with all-service jacket and vapor barrier (2-1/2" pipe and larger).

2. Domestic hot water: 1" fiberglass with all service jacket and vapor barrier.

3. Roof drain bodies and roof drain piping: 1" fiberglass with all service jacket and vapor barrier.

4. Chilled water: 1" fiberglass with all-service jacket and vapor barrier (2" pipe and smaller); 1-1/2" fiberglass with all-service jacket and vapor barrier (2-1/2" – 10" pipe); 2" fiberglass with all-service jacket and vapor barrier (12" pipe and larger).

5. Heating hot water: 1" fiberglass ASJ for 1" and smaller, 1-1/2" fiberglass with all-service jacket and vapor barrier for 1-1/4" and larger.

6. Lavatories: ADA insulation kits.

II. GENERAL MECHANICAL REQUIREMENTS

A. The Contractor will submit a submittal list plus shop drawings for all major pieces of equipment and materials. Layout and coordination drawings shall be required for piping, fire protection and sheet metal. Shop drawings of UL approved penetration methods will be submitted.

B. All motors shall be built to NEMA standards and have high temperature winding insulation. All motors 1 HP and larger shall be premium efficiency type. Motors 1/2 HP and above shall be 460 volt, three phase. Smaller motors shall be 120 volt, single phase.

C. Variable frequency drives, where specified to be provided, will be UL listed and ETL or CSL certified. The drive shall include the motor starter for the driven motor, all automatic controls and a manual by-pass switch. The drive shall comply with the latest FCC regulations for radiated and conducted EMI and RFI.

D. Framed openings and sleeves shall be provided for all piping and ductwork passing through construction. Openings shall be sealed with an approved fire sealant in fire rated construction. Fire dampers or combination fire/smoke dampers shall be installed where required by Code.

E. Mechanical piping shall be identified with manufactured labels. All pipe markings shall include flow arrows.

F. All valves shall be tagged and indexed, except for shut-off valves at identified individual pieces of equipment.

G. All piping shall be cleaned and tested before equipment is installed and insulation is applied. Testing shall be as required by Code or as specified for those systems.

H. All equipment furnished shall be adjusted to operate properly. All bearings shall be aligned. All safety devices shall be tested. Major pieces of equipment shall have factory personnel start-up. Any necessary adjustments shall be made to the systems.

I. The mechanical systems shall be tested and balanced by an independent Testing and Balancing Agency, a firm whose primary business is Test and Balance, utilizing NEBB certified personnel. The Testing and Balancing Agency shall provide a complete report documenting the performance of all systems. Systems to be tested shall include:

1. All air supply, return and exhaust systems.
2. Chilled/condenser water system.
3. Hot water heating system.
4. Night Sky System
5. Solar System

The testing and balancing will be contracted separately from the construction contract. Mechanical Contractor will assist Balancing Contractor.

J. Access doors will be specified for installation in general construction where necessary to provide access for operation and maintenance. The minimum size of the access doors is to be 24" x 24".

K. Housekeeping pads will be installed under all major floor mounted mechanical equipment. Pads shall be a minimum of 3 1/2" high.

III. PLUMBING

A. PLUMBING SYSTEMS

1. Water Supply Systems

a. Domestic cold water will be provided to mechanical equipment, plumbing fixtures, and other outlets requiring cold water.

b. Backflow preventors and/or vacuum breakers will be provided at all interconnection between the domestic water system and points of possible contamination.

c. Shutoff valves will be provided for each gang of fixtures for maintenance purposes.

d. Domestic water booster system with regulators if required for the domestic system.

e. "Grey" water system integrated with the Storm Water/Night Sky system to utilize excess water in lieu of the building domestic water service. A booster pump will be used to provide adequate pressure for flushing water closets.

f. Refer to Rumsey Engineering documents for collection of condensate waste for make up water to cooling tower or "Grey" water system.

2. Domestic Water Heating System

a. Toilet Rooms and Showers: Domestic water heating (140°F) will be provided by multiple gas fired boilers integrated with the heating system. Refer to Rumsey Engineering documents for further description. Central hot water systems will be provided with a recirculating system to maintain hot water at each lavatory and adjustable mixing valves to reduce temperature to 120°F or less.

b. Kitchens: Domestic hot water heating will be provided by gas fired heaters, storage tank and recirculating system as required to meet City and Health Department requirements. Final discharge temperature and hot water storage and production capability will be determined based upon selected kitchen equipment and food service consultant requirements.

c. Each hot water circulating pump will be controlled by an adjustable timer or energy management system for operation only during occupied hours.

3. Sanitary, Waste and Vent System

a. A soil, waste and vent system for plumbing fixtures, floor drains and mechanical equipment arranged for gravity flow will be provided.

b. Sanitary and waste piping shall be sloped a minimum of 1/8" per foot for piping above 3". Vents shall be sloped to drain. Pipe sizing will be in accordance with the Plumbing Code. All sanitary piping 3" and below shall be installed with horizontal slope of 1/4" per foot.

4. Storm Drainage System

a. A storm drainage system of interior roof drains and insulated downspouts will be provided for all flat roofs. An independent system of overflow drains and separate piping to sewer mains, culverts, or wall outlets will be provided where required by Code.

b. The storm water drainage system will be integrated with the Night Sky Radiant Cooling system and a "grey" water system. Any water collected by the system above the usage requirements of the building will be diverted to the site storm drainage system.

B. PLUMBING FIXTURES

1. All plumbing fixtures, faucets and trim will be standard commercial lines. Fixtures and fittings will be provided to comply with ADA requirements.

a. Water Closets: White, siphon jet, water saver vitreous china, elongated, wall hung with hard-wired, automatic hands-free flush valve, carrier, and open front seat with stainless steel hinges.

b. Urinals: Waterless.

c. Lavatories: White, vitreous china, self rimming, countertop or wall hung, with hard-wired, automatic, hands-free, low flow faucets, loose key stops, flow restrictors, cast brass P-trap and grid drain. Furnish and install mixing valves to provide tempered water to all lavatories.

d. Janitors Sink: Floor mounted, 24" x 24" terrazzo receptor, faucet with vacuum breaker, bucket hook, wall brace and check stops, cast brass grid drain and P-trap.

e. Electric Water Cooler: Stainless steel, recessed, self contained, ADA dual height fountains, wall hung, with cast brass P-traps and loose key stops.

f. Showers: Wall mounted recessed type with thermostatic mixing valves.

h. Thermostatically controlled mixing valves will limit hot water temperatures at fixtures (below 120°F).

C. PLUMBING EQUIPMENT

1. Drains (accessories will be provided as required to match construction):

a. Roof drains shall be general purpose type with cast iron body and dome, gravel stop and no-hub outlet. Alternately, gutters and downspouts will be utilized.

b. Floor drains shall have a cast iron body, seepage flange, and no-hub outlet. Strainers will be provided to match floor construction and use. Floor drains will be provided in mechanical rooms, toilet rooms and vending areas per equipment arrangement.

2. Wall hydrants shall be non-freeze type with nickel bronze box and cover. Wall hydrants shall have a vacuum breaker and shall be loose key operated. One freezeproof wall hydrant shall be provided on each exterior face of the building.

3. Hose bibbs shall be rough brass with vacuum breaker, chrome plated loose key in public areas with wheel handle in all other areas. Hose bibbs will be provided in major mechanical rooms.

VI. FIRE PROTECTION

A. The building shall be fully sprinklered. A standpipe system shall be provided if required by code with 2-1/2" valved and capped outlets at each exit door and at each stairway. Alarmed zoned control valves, tamper switches and flow switches will be provided. The system will be hydraulically calculated in accordance with NFPA occupancy classifications. A fire pump shall be provided if required to obtain code required

flow/pressure. The system will be designed to NFPA standards unless the Owner's insurer has additional requirements.

B. Kitchen: An automatic shutoff valve will be provided for the natural gas supply to each lineup of kitchen equipment. The valve will be closed by operation of the kitchen hood fire suppression system.

C. Fire Pumps: A fire pump and jockey pump along with all necessary controllers and accessories will be provided to serve the standpipe and sprinkler systems.

D. The office building will be fully sprinklered. Systems will be specified to meet Factory Mutual requirements. A system for office areas will be specified for light hazard spacing (225-sq. ft/head) with pipe sizing for ordinary hazard density, based on 0.10 GPM per 1,500 square feet. An alternate bid will be taken to provide 200 sq. ft/head and density of .15 GPM per 2500 sq. ft. Garage areas will be ordinary hazard spacing (130-sq. ft/head) with pipe sizing for .3 GPM per 2500 square feet and 286° 1/2" orifice heads.

E. The office building will utilize wet systems with dry systems provided in areas where freezing might occur. The sprinkler system will be supplied from the standpipe system. Pendant heads will be installed in the ceilings of all areas except tenant areas. The unfinished tenant areas will have upright heads installed on the branch lines. Size sprinkler piping to allow for additional heads necessary for future tenant finish. Finished areas shall have concealed-type heads.

F. The garage will be sprinklered. Garage systems will be dry pipe. The garage will have a wet standpipe system.

G. The office building will have wet standpipes with one standpipe in each stair tower plus a 3-way roof outlet.

DIVISION 16000
ELECTRICAL

I. ELECTRICAL POWER EQUIPMENT AND MATERIALS

A. Electric Service: Refer to Utility Services.

B. Electrical Power Distribution

1. Power will be distributed from the main switchboard throughout the building to various electrical closets and major mechanical equipment. Switchboards and

panelboards shall be located in dedicated electrical rooms or closets for code and safety reasons.

2. All lighting and mechanical equipment will be served at 480Y/277V, 3 phase, 4 wire, 60 hertz. Convenience power, incandescent specialty lighting and computer equipment will be served at 208Y/120V, 3 phase, 4 wire, 60 Hertz as required.

3. Motors of 1/2 horsepower and larger will be 480 volt or 208 volt, 3 phase, 3 wire. Motors less than 1/2 horsepower will be served at 277 volt or 120 volt service, 1 phase, 2 wire.

C. Emergency Power

1. Refer to document entitled "DNR Green Building Relocation Automation Issues dated August 1, 2000.

D. Electrical System Components

1. Receptacles

a. Receptacles for maintenance, any special equipment, and near rooftop HVAC equipment will be provided as required by Code.

b. Receptacles will be provided in each space per program requirements. At a minimum, each regularly occupied space will have at least one receptacle per wall.

c. All receptacles in restrooms, janitor closets and above counter tops near sinks will be GFCI type.

d. Duplex receptacles will be specification grade, 20 amp, grounding type, and color as desired by the Architect.

e. Mounting heights will be per ADA requirements.

f. Floor service fittings will be combination type (duplex receptacle and telephone services), back-to-back design, extruded aluminum.

2. Grounding

a. The electrical service and all switchgear, switchboards, transformers, motor control centers, motor starters, panelboards, and derived systems will be grounded per the NEC.

3. Mechanical Equipment Connections

a. Electrical power connections will be made to all mechanical equipment, unit heaters, drinking fountains, fan powered terminal boxes, and elevators including furnishing of all electrically associated devices such as disconnect switches, contactors, magnetic or manual starters, lock-out switches, etc., which are not furnished under the Mechanical, Plumbing and Fire Protection Sections.

4. Switchboards

a. Service entrance equipment shall be a low voltage main switchboard will be completely assembled NEMA Class 2, front accessible with aluminum or copper bus bars, full neutral bus, and separate ground bus. All bus work will be braced to withstand available RMS symmetrical fault currents. Protective devices will be provided with approved barrier between sections and extended load terminals.

1) Main service disconnect device(s) will be an electronically operated fused switch that can be interlocked with a future photovoltaic array.

2) Feeder devices will be fused switches. All devices will be equipped with current limiting fuses, such that switchboard will be fully rated for available fault current.

3) Fused switches 800 amperes and larger will be individually mounted and will be bolted-pressure, load break type complete with time-delay, current-limiting fuses.

4) Switches 600 amperes and smaller will be quick-make, quick-break, complete with time-delay or fast-acting current limiting fuses as required.

5) Ground fault protection will be provided for 480-volt services on each service disconnect rated 1000A or more.

6) Electronic metering will be provided on main service switchboards.

7) Compartments for Utility Company current transformers will be provided.

8) Space for connection of future photovoltaic array.

5. Transformers (480 Volt, 3 phase, 4 wire primary to 208Y/120V, 3 Phase, 4 Wire secondary).

a. Dry type, ventilated, 200°C insulation system temperature class.

b. NEMA standard voltage taps.

c. NEMA standard sound ratings.

d. K factor of 4.

6. Starters and Controls

a. All temperature control and mechanical equipment interlock wiring, raceways and associated devices will be provided under the Temperature Control System Section. All alarms, plumbing and fire protection control and equipment interlock wiring, raceways and associated devices will be provided under this Section. All fire detection, alarm and communications wiring, raceways and associated devices will be provided under this Section.

b. Magnetic starters will be combination type complete with fusible switch, auxiliary contacts, overload relays, individual fused control transformer, hand-off-automatic selector switch or start-stop push button, and pilot lights.

c. Reduced voltage starters will be provided for motors 75 horsepower and larger unless equipped with VFD's.

7. Lighting and Branch Circuit Panelboards

a. 480Y/277 volt panelboards and 208Y/120 volt panelboards will be circuit breaker type.

b. Typed directories will be provided in each panelboard. Main breakers will be provided where required by code.

a. A minimum of 25% spare circuit breakers will be provided in each panelboard.

b. 208/120-volt panelboards shall have 200% neutrals.

8. Distribution Panelboards

a. Panelboards will be fused switch type.

b. Typed directories will be provided in each panelboard.

9. Cables, Wiring and Raceways

a. Cable and wiring will be 75°C rated insulation, except as noted below, copper conductors and color coded.

b. Lighting and receptacle branch circuit conductors #10 and smaller shall be solid copper, type "THW", "THWN" or "THHN". Minimum size shall be #12 AWG, except control wiring may be #14 AWG, type "THHN".

c. Conductors #8 and larger shall be stranded copper with "THW" or "XHHW" insulation.

d. Final wiring connections to light fixtures, motors and dry type transformers will be run in flexible metal conduit. Liquid tight flexible conduit shall be used in wet locations or where exposed to the weather. Flexible conduits will be used for connections to vibrating or rotating equipment.

e. All wiring will be run in conduits. Minimum size conduit will be 1/2".

f. Raceways inside the building will be electrical metallic tubing.

g. A green-wire ground shall be run in each conduit.

h. Cable and conduit supports, couplings and fittings, pullboxes and other wiring materials and devices will be provided as required.

i. ALTERNATE: Type MC cable instead of conduit in concealed locations indoors only. Home runs shall be run in conduit.

j. ALTERNATE: Aluminum alloy conductors only for feeders 100A and larger.

10. Light Switches, Receptacles and Coverplates

a. Lighting switches will be quiet type, toggle or key type, specification grade, and color as desired by Architect.

b. Duplex receptacles will be specification grade, grounding type, and color as selected by Architect.

c. Coverplates for wall devices will be brushed stainless steel. All plates for multiple gang requirements will be one-piece combination.

11. Concrete Pads

a. Concrete housekeeping pads will be provided for floor-mounted electrical equipment in the building and for pad mounted utility transformers.

II. FIRE DETECTION AND ALARM SYSTEM

A. The fire detection and alarm system will be UL listed, electrically supervised Class "B", Central Station type with individually addressable alarm devices. The system will provide fire detection and alarm, complete with manual pull stations, ceiling mounted products of combustion detectors, duct mounted products of combustion detectors, thermal detectors and alarm signal/devices with flashing indicator lights where required by Code.

B. Upon receipt of a fire alarm, the fire alarm system will shutdown the HVAC system, recall elevators, sound audible/visual alarm devices throughout the building, and signal the Central Station Alarm Company.

C. Mounting height, locations and specifications of audible and visual devices will be per ADA.

1. Public spaces such as corridors, restrooms and conference rooms will have audible/visual devices.

D. The fire alarm panel will be located at the main entrance.

E. An audible only electric alarm bell shall be located near the Water Service Room outdoors.

F. Set up for dedicated phone line to private central station.

G. Manual pull stations with alarmed tamper covers will be provided at exits.

H. Kitchen hood fire suppression systems will be monitored.

I. Smoke detectors will be provided at return air shaft openings on each floor in multistory buildings.

J. Smoke detectors will be provided for air handling units.

III. SPECIAL SYSTEMS

A. Telephone, CATV, and Data Network Communications Systems.

1. Provisions for Tenant-furnished and installed telephone, CATV and data network equipment will be made to allow for horizontal and vertical distribution of communications cabling throughout the building. Such provisions may include empty conduits, cable trays, conduit sleeves, pull boxes, outlet boxes, telephone terminal boards, etc.

2. Communication outlets will consist of a junction box with 1" conduit stubbed into accessible ceiling space above.

3. A ground wire will be provided at the main communications/data room and at each communications/data closet on each floor.

4. Tenant-furnished and installed communications cable run exposed in supply or return air plenums shall have a plenum rated covering material.

5. One fourplex receptacle will be provided at each communications/data closet.

6. Conduit from the top floor communications/data closets shall be stubbed through the roof and capped for future satellite dish cabling.

B. Lightning Protection System

1. A UL Master Label System per NFPA 78 will be installed.

2. Transient Voltage Surge Suppression, parallel type, will be installed on service entrance equipment.

C. Security System

1. The system will be designed by the Security Consultant.

D. Public Address System

1. Part of Owner-furnished telephone system.

E. Window Washing System

1. Weatherproof receptacles will be provided at the roof level to provide 208 volt, three-phase power to the window washing equipment.

F. Area of Rescue Assistance Intercom System

1. Not required for a sprinklered building with an approved evacuation plan.

G. Heat Tracing

1. Heat tracing will be provided on portions of piping subject to freezing.

IV. EQUIPMENT AND DEVICE IDENTIFICATION

A. All equipment and devices shall have identification nameplates or tags.

V. VENDORS

A. FSC/Smith & Boucher standard specifications typically name three acceptable vendors for each type of equipment.

END OF REPORT.